Lecture Plan for SSY100 Antenna Engineering 2014/2015

Week#	Week day#	Date	Time	Room	Responsible	Lecture	Chapter in compendium	Topic	Alternative litterature
13	1	23/03/15						Start of reading period	
13	2	24/03/15	1315-1500	EL42	PSK	**Lect 1**	1.1-1.4	Introduction: Course information. Examples of antenna and antenna types. Applications and brief history. Some existing and future antenna systems and their frequencies and antenna types. About antenna terminology. Repetition of dB and basic vector formulas (cross and scalar products).	[1] 1.1-1.6 [2] 1.1-1.5 [3] 1.2 [4] -
13	2	24/03/15	1515-1700	EL42	RM	Extra		Antenna handbook. Matrix representations for two-ports. S-parameters.	
13	4	26/03/15	1315-1500	EL42	PSK	**Lect 2**	2.1-2.3	Characterization of antennas for line-of-sight (LOS) systems: Plane waves. Linear and circular polarization. The radiation field function: Phase reference point, polarization, phase center, directivity, sidelobes, E- and H-planes.	[1] 2.1-2.7, 2.12 [2] 1.6, 1.9 [3] 8.1.1 [4] 2.1-2.5, 14.7
13	4	26/03/15	1515-1700	EL42	CB	Ex 1		dB exercise. Polarization of plane waves, polarizer.	
14	2	31/03/15	1315-1500	EL42	JY	**Lect 3**	2.4-2.5	Rotationally symmetric antennas: BOR0 and BOR1 antennas (BOR = Bodies of Revolution). System characteristics: gain, efficiency, total radiated power, equivalent noise temperature and G/T.	[1] 2.8-2.11, 2.14, 2.18 [2] 1.8 [3] 8.1.2, 8.1.5,8.1.6 [4] 15.2, 15.4, 15.7-15.8
14	2	31/03/15	1515-1700	EL42	CB	Ex 2		Phase reference point. Phase center.	
14	4	02/04/15	1315-1500	EL42	RM	**Lect 4**	2.6-2.9	Equivalent circuits on transmit and receive. Antenna impedance and matching. Transmission between two antennas in free space. Antenna measurements.	[1] 2.13, 2.17, 17.1-17.10 [2] 1.10-1.11 [3] 8.1.10 [4] 15.6, 15.11
14	4	02/04/15	1515-1700	EL42	CB	Ex 3		BOR antennas. G/T.	
15								One week break due to Easter, self studies	
16								One more week break due to repeat exams, self studies. Also week of EuCAP2015 conference of antenna group.	
17	2	21/04/15	1315-1500	EL42	AAG	**Lect 5**	3.1-3.5	Characterization of antennas for multipath environments: Multipath environment and Rayleigh fading. Single antennas: Mean effective gain, radiation efficiency. Multiport antenna systems: Embedded element patterns, embedded element radiation efficiency, mutual coupling and correlation. Antenna diversity: Apparent, actual and effective diversity gain.	[1] 16.1-16.12 [2] - [3] 8.4 [4] -
17	2	21/04/15	1515-1700	EL42	CB	Ex 4		Equivalent circuits.	
17	4	23/04/15	1315-1500	EL42	AAG	**Lect 6**	3.6-3.8	MIMO systems (Multiple Input Multiple Output): Characterization of active terminals: Total radiated power, receiver sensitivity and bit error rate (BER), realized diversity gain, and user interaction (head loss and specific absorption rate). Measurements in reverberation chamber. Transmission between two antennas in multipath	[1] 16.1-16.12 [2] - [3] 9.3 [4] -
17	4	23/04/15	1515-1700	EL42	MSK	Ex 5		Characterization of antennas for multipath environments.	
18	2	28/04/15	1315-1500	EL42	RM	**Lect 7**	4.1-4.7	Incremental elementary sources of radiation: The incremental electric current (Hertz dipole). The incremental equivalent magnetic current. The directive incremental Huygen's source. Reciprocity. Reaction. Imaging.	[1] 3.4, 3.6, 4.2, 5.2 [2] 2.1, 2.4 [3] 8.1.9 [4] 16.2, 16.8
18	2	28/04/15	1515-1700	EL42	MSK	Ex 6		MIMO systems.	
								Walborg 30/4 half workday. No lectures.	

19	2	05/05/15	1315-1500	EL42	JY	**Lect 8**	5.1-5.7	Small antennas: Electric monopole and dipole. Yagi antennas. Log-periodic and other ultra wideband antennas. Electric loop antenna. Helical and spiral antennas. Slot antennas.	[1] 4.3, 4.5, 5.3-5.4, 9.2, 9.6, 10.3, 11.1-11.4 [2] 2.2, 5.1-5.4, 5.7, 6.1-6.5 [3] 8.1.10 [4] 16.4, 16.5, 16.9-16.11
19	2	05/05/15	1515-1700	EL42	AR	Ex 7		Incremental elementary sources of radiation.	
19	4	07/05/15	1315-1500	EL42	RM	**Lect 9**	6.1-6.4	Small antennas: Microstrip patch antennas. Inverted F-antennas or quarterwave patch antennas. Examples of practical small antennas for mobile terminals.	[1] 14.1-14.7 [2] - [3] 8.2.5-8.2.8 [4] 18.6
19	4	07/05/15	1515-1700	EL42	AR	Ex 8		Small antennas.	
20	2	12/05/15	1315-1500	EL42	PSK	**Lect 10**	7.1-7.5 8.1-8.9	Aperture antennas: Aperture theory: aperture distribution, directivity, sidelobes. Tolerances and fundamental gain limitations of large antennas (including supergain). Horn antennas: Pyramidal horns, conical horns, corrugated horns.	[1] 12.1-12.9, 13.1-13.10 [2] 8.1-8.5 [3] - [4] 18.1-18.5
20	2	12/05/15	1515-1700	EL42	AR	Ex 9		Small antennas. Microstrip antennas.	
								Ascension Day on 14 May, No lectures 14-15 May.	
21	2	19/05/15	1315-1500	EL42	AAG	**Lect 11**	10.1-10.2	Array antennas: Linear phased arrays. Isolated and embedded element patterns. Array factor as element-by-element sum. Array factor as grating-lobe sum (aperture approach). Directivity, sidelobes and grating lobes.	[1] 6.1-6.8 [2] 3.1-3.5 [3] - [4] 19.1-19.6
21	2	19/05/15	1515-1700	EL42	AR	Ex 10		Aperture antennas.	
21	4	21/05/15	1315-1500	EL42	AAG	**Lect 12**	10.3, 11	Array antennas: Planar phased arrays. Mutual coupling, active antenna impedance and scan blindness. Fundamental efficiency and directivity limitations of multiport/multibeam arrays.	[1] 6.10-6.12, 8.6-8.7 [2] 3.6-3.8 [3] - [4] 19.7-19.10
21	4	21/05/15	1515-1700	EL42	CB	Ex 11		Linear phased arrays.	
22	2	26/05/15	1315-1500	EL42	JY	**Lect 13**	9.1-9.5	Reflector antennas: Paraboloidal antennas, Cassegrain antennas, feeds, phase center, aperture illumination taper, diffraction, blockage, subefficiencies, sidelobes. Examples of antennas used in radio telescopes.	[1] 15.1-15.5 [2] 8.6 [3] - [4] 18.7-18.11
22	2	26/05/15	1515-1700	EL42	CB	Ex 12		Planar phased arrays	
22	4	28/05/15	1315-1500	EL42	AZ	**Lect 14**	11	Fundamental limitation of antennas. Miniaturization of antennas and its fundamental bandwidth limitations. Materials for antenna design: Theoretical materials and surfaces used in analysis: Perfect electric conductor (PEC), perfect magnetic conductor (PMC), PEC/PMC strip grids (soft and hard surfaces). Artificial materials / periodic surfaces: Corrugations, strip-loaded surfaces.	[1] 11.5, 14.4 [2] - [3] 8.2.1-8.2.2 [4] -
22	4	28/05/15	1515-1700	EL42	AR	**Ex 13 & 14**		Reflectors and fundamental limitations	
23	1	01/06/15	?		AZ	extra		Review of previous exams. Date and time to be decided by students.	
23	5	05/06/15	1400-1800	H	JY	**Exam**			
24	5	12/06/15	1300-1700	room 7312	JY	Exam Checking			
35	5	28/08/15	0830-1230	M	JY	**Re-exam**			

PSK = Per-Simon Kildal, JY = Jian Yang, RM = Rob Maaskant, AAG = Andres Alayon Glazunov,
AZ = Ashraf Uz Zaman, AR = Aidin Razavi, CB = Carlo Bencivenni, MSK = Madeleine Schilliger Kildal

[1] C.A. Balanis, *Antenna Theory: Analysis and Design*, 3rd ed., John Wiley & Sons, Inc., 2005.
[2] W. L. Stutzman, G. A. Thiele, *Antenna Theory and Design*, John Wiley & Sons, Inc., 1981
[3] R. Vaughan, J. B. Andersen, *Channels, Propagation and Antennas for Mobile Communications*, IEE electromagnetic waves series, no. 50, 200
[4] S. J. Orfanidis, *Electromagnetic Waves and Antennas*, http://www.ece.rutgers.edu/~orfanidi/ewa/